



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Handwritten signature and date: 5-20-03

Applicant: Tadashi Senoo, et al.
Appl. No.: 09/162,992
Filed: September 30, 1998
Title: GEL ELECTRODE SECONDARY CELL
Art Unit: 1745
Examiner: T. Dove
Docket No.: 112857-037

Commissioner for Patents
Washington, DC 20231

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APPELLANTS' APPEAL BRIEF

Sir:

Appellants submit this Appeal Brief in support of the Notice of Appeal filed on March 19, 2003.

I. REAL PARTY IN INTEREST

The real party in interest for the above-identified patent application on appeal is Sony Corporation by virtue of an Assignment dated November 20, 24, 26 and 30, 1998 and recorded at the United States Patent and Trademark Office at reel 9622, frame 0510.

II. RELATED APPEALS AND INTERFERENCES

Appellants do not believe there are any known appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision with respect to the above-identified Appeal.

III. STATUS OF CLAIMS

Claims 2-4, 6-9 and 12 are pending in the above-referenced patent application. A copy of the appealed claims is attached in the Appendix. In the Final Office Action dated November 13, 2002, § 112, second paragraph; 2-9 and 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over EP 072405 A1 ("Akashi") in view of U.S. Patent No. 5,522,127 ("Ozaki").

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IV. STATUS OF AMENDMENTS

Claim 12 was amended and claim 5 was cancelled to overcome the objection to claims 5 and 12 and the rejection of claims 2-9 and 12 under 35 U.S.C. § 112, second paragraph in response to the Final Office Action. In an advisory action issued on February 27, 2003, the objection to claims 5 and 12 and rejection of claims 2-9 and 12 under 35 U.S.C. § 112, second paragraph were withdrawn. Accordingly, the amendments in response to the Final Office Action were entered and thus for appeal purposes claims 2-4, 6-9 and 12 are presently pending, a copy of which are attached herewith as previously discussed.

V. SUMMARY OF INVENTION

The Summary of the Invention is provided as follows:

The present invention generally relates to gel electrolyte secondary cells. More specifically, the present invention relates to gel electrolyte secondary cells that employ a negative electrode including a graphitized carbonaceous material obtained from a number of meso-carbon micro-beads. The gel electrolyte secondary cells of the present invention can display both large discharge capacities and high charging/discharging efficiency. See, Specification, page 7, lines 13-19.

The gel electrolyte secondary cells include, in general, a positive electrode, a negative electrode and a gel electrolyte wherein the negative electrode contains a graphitized carbonaceous material obtained by firing meso-carbon micro-beads. See, Specification, page 8, lines 15-18. The meso-carbon micro-beads used as the starting material for the graphitized carbonaceous material are known as graphitizable carbon. In general, the meso-carbon micro-beads are microglobules of liquid crystal produced as an intermediate associated with a phase transition from a liquid phase to a solid phase as a result of heat-treating an organic compound. See, Specification, beginning on page 8 at line 19 to page 9 at line 2.

In particular, coal or petroleum pitch, such as coal tar, is heat-treated in an inert atmosphere at a temperature from 400°C to 500°C to produce the meso-carbon micro-beads. This produces globules of liquid crystal which are separated from the pitch matrix as quinoline-insoluble components. The separated globules may be pulverized or classified by, for example, particle size adjustment if desired. See, Specification, page 9, lines 3-7.

The graphitized carbonaceous negative electrode material is produced by firing the meso-carbon micro-beads at an elevated temperature. Preferably, the firing temperature ranges from 2500°C to 3500°C, more preferably from 2800°C to 3000°C. See, Specification, page 9, lines 8-11. The graphitized carbonaceous material is mixed with a binder to prepare the negative electrode material which is coated on one or both surfaces of a current collector at a specified thickness. See, Specification, page 9, lines 12-16.

The positive electrode material can be made from, for example, a lithium-containing material. Preferably, this material is capable of doping/dedoping a sufficient amount of lithium. In general, this material is made from a complex lithium oxide and a transition metal. See, Specification, page 11, lines 17-21.

The gel electrolyte material includes an electrolyte salt, a non-aqueous solvent and a high-molecular weight material. The electrolyte salts include, for example, lithium salts. The preferred lithium salt is LiPF_6 . See, Specification beginning at page 12, line 20 to page 13, line 9.

The non-aqueous solvent is preferably selected so that its potential window is in a range from -0.3V to 4.9V with respect to the lithium potential so that a sufficiently high ion conductivity can be afforded to the gel electrolyte and so that a gel with good film forming properties can be prepared. In an embodiment, the non-aqueous solvent at least includes propylene carbonate in an amount ranging from 10 mol% to 75 mol% and ethylene carbonate. See, Specification, page 13, lines 10-17.

The high molecular weight material has a number average molecular weight that ranges from 5000 to 500000. Preferably, the high molecular weight material includes polyacrylonitriles including copolymers thereof in addition to other suitable monomers. See, Specification, pages 13 and 14.

The gel electrolyte secondary cell of the present invention is made by layering the negative electrode that contains the graphitized carbonaceous material, positive electrode and the gel electrolyte, in the order of the negative electrode, gel electrolyte and the positive electrode, and accommodating the layered assembly in the outer packaging of the cell. It should be appreciated that there may additionally be provided gel electrolytes on the outer sides of the negative electrode and the positive electrode. See, Specification, page 11, lines 1-6.

Applicants have discovered that discharge capacity losses can be suppressed to lower values even if propylene carbonate is contained in the gel electrolyte and the graphitized carbonaceous material powders obtained from meso-carbon micro-beads are small enough in size to lower the impedance sufficiently. The result is high discharging capacity and a high charging/discharging efficiency. See, Specification, page 11, lines 8-13. Applicants have conducted a number of experiments that demonstrate the beneficial and desirable effects of the present invention. See, Specification, pages 15-24.

VI. ISSUE

The issue on Appeal is as follows:

1. Would the gel electrolyte secondary cell as defined by Claims 2-4, 6-9 and 12 have been obvious at the time of invention to one of ordinary skill in the art under 35 U.S.C. § 103(a) over *Akashi* and *Ozaki*?

VII. GROUPING OF CLAIMS

Appellants do not argue for the separate patentability of each of the dependent claims separate and apart from the independent claim set forth in detail below pursuant to the requirements of 37 C.F.R. §1.192(7), unless otherwise specified.

VIII. ARGUMENT

A. The Claimed Invention -- Independent Claim

On Appeal, claim 12 is the sole independent claim. Independent claim 12 provides as follows:

Claim 12 recites a gel electrolyte secondary cell. The gel electrolyte secondary cell includes a positive electrode, a negative electrode and a gel electrolyte. The negative electrode includes a current collector and a powder mixture wherein the powder mixture includes a graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads and a binder. The powder mixture is coated on the current collector at a thickness ranging from 10 μm to 200 μm . The gel electrolyte includes an electrolyte salt, a non-aqueous solvent and a high-molecular weight material having a number average molecular weight ranging from 5000 to

500000 wherein the non-aqueous solvent at least includes propylene carbonate in an amount ranging from 10 mol% to 75 mol% and ethylene carbonate.

B. The Rejection

Claims 2-4, 6-9 and 12 stand rejected under 35 U.S.C. § 103(a) over *Akashi* in view of *Ozaki*. The Examiner primarily relies on *Akashi* and thus relies on *Ozaki* to remedy the deficiencies of *Akashi*.

C. The Patent Office Has Failed to Establish a *Prima Facie* Case of Obviousness

Appellants respectfully submit that the rejection of Claims 2-4, 6-9 and 12 under 35 U.S.C. §103 should be reversed based on the fact that the Patent Office has failed to establish a *prima facie* case of obviousness. To the extent that the references are even combinable, the Patent Office has failed to establish that the cited references, alone or in combination, disclose or suggest at least a number of features of the claimed invention as required by Claims 2-4, 6-9 and 12. Further, Appellants believe that the Patent Office has improperly relied on “hindsight” reasoning to allegedly arrive at the claimed invention in view of the cited references.

1. The Applicable Law

The Federal Circuit has held that the legal determination of an obviousness rejection under 35 U.S.C. §103 is:

whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made...The foundational facts for the *prima facie* case of obviousness are: (1) the scope and content of the prior art; (2) the difference between the prior art and the claimed invention; and (3) the level of ordinary skill in the art...Moreover, objective indicia such as commercial success and long felt need are relevant to the determination of obviousness...Thus, each obviousness determination rests on its own facts.

In re Mayne, 41 U.S.P.Q.2d 1451, 1453 (Fed. Cir. 1997).

In making this determination, the Patent Office has the initial burden of proving a *prima facie* case of obviousness. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). This burden may only be overcome “by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that

individual to combine the relevant teachings.” *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

One skilled in the art, in theory, may look to the combined teachings of the cited references to explain what one aspect of the claimed invention discloses. However, the Federal Circuit has criticized this motivation to combine analysis as being “hindsight reconstructive” because the motivation to combine the cited references was first disclosed in the present invention. *In re O’Farrell*, 853 F.2d 894, 902-03, 7 U.S.P.Q.2d 1673, 1680-81 (Fed. Cir. 1988).

Further, the Federal Circuit has held that “obvious to try” is not the standard under 35 U.S.C. §103. *Ex parte Goldgaber*, 41 U.S.P.Q.2d 1172, 1177 (Fed. Cir. 1996). “An-obvious – to-try situation exists when a general disclosure may pique the scientist curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient teaching of how to obtain the desired result, or that the claim result would be obtained if certain directions were pursued.” *In re Eli Lilly and Co.*, 14 U.S.P.Q.2d 1741, 1743 (Fed. Cir. 1990).

“If the examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent.” *In re Oetiker*, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992).

2. The §103 Rejection of Claims 2-4, 6-9 and 12 Should Be Reversed Because the Patent Office Has Failed to Establish a *Prima Facie* Case of Obviousness

Appellants respectfully submit that the Patent Office has failed to establish a *prima facie* case of obviousness with respect to the § 103 rejection of Claims 2-4, 6-9 and 12. Of the pending claims, claim 12 is the sole independent claim. Claim 12 recites a gel electrolyte secondary cell that includes a positive electrode, a negative electrode and a gel electrode. The negative electrode includes a current collector and a powder mixture including a graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads and a binder wherein the powder mixture is coated on the current collector at a thickness ranging from 10 micrometers to 200 micrometers. The gel electrolyte includes an electrolyte salt, a non-aqueous solvent at least including propylene carbonate in an amount ranging from 10 mol% to 75 mol%, ethylene carbonate and a high-molecular weight material having a number average molecular weight ranging from 5000 to 500,000.

Appellants have uniquely discovered that a gel electrolyte secondary cell which combines, for example, a negative electrode made from a current collector and coated with a negative electrode material including a graphitized carbonaceous material obtained from meso-carbon micro-beads and a gel electrolyte composed of a high molecular weight material effectively can achieve a large discharge capacity and a high charging/discharging efficiency as compared to electro-chemical cells that employ typical non-aqueous electrolytes.

QxP In contrast, Appellants believe the cited art fails to disclose or suggest at least a number of features of the claimed invention. For example, nowhere does the *Akashi* reference disclose or suggest a negative electrode material that includes a graphitized carbonaceous material obtained from meso-carbon micro-beads. At the outset, the Patent Office appears to have given little, if any, patentable weight to the claim term "obtained from a plurality of meso-carbon micro-beads" of the claimed invention. This is improper.

Indeed, this claim term defines structural characteristics of the claimed graphitized carbonaceous material. As disclosed in the specification on page 9 at lines 3-7, meso-carbon micro-beads are derived from, for example, coal or petroleum pitch, such as coal tar pitch, that has been heat-treated in an inactive atmosphere at a temperature ranging from 400°C to 500°C. The meso-carbon micro-beads can then be fired at an elevated temperature ranging from 2500°C to 3500°C, more preferably 2800°C to 3000°C. See, Appellants' Specification, page 9, lines 8-11.

As further defined, the powders of the graphitized carbonaceous material have a specific surface area, preferably from 0.1 to 10 m²/g, more preferably from 0.1 to 5 m²/g. In view of same, one skilled in the art would be able to ascertain the structural features of the claimed graphitized carbonaceous material as defined by the claim term "obtained from a plurality of meso-carbon micro-beads." Thus, Appellants believe that the Patent Office's characterization of the claim term "obtained from a plurality of meso-carbon micro-beads" as a product-by-process limitation is improper.

In any event, the claimed graphitized carbonaceous material is clearly distinguishable over what the *Akashi* reference allegedly discloses. Foremost, *Akashi* merely discloses a laundry list of possible negative electrode active materials that may include metallic lithium, a lithium alloy and a carbonaceous material including any number of examples none of which disclose a

graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads as required by the claimed invention. See, *Akashi*, page 5, lines 12-16.

Indeed, the primary focus of *Akashi* relates to a fire-retardant gel electrolyte and not the negative electrode material in contrast to the claimed invention. As previously discussed, Appellants have demonstrated that a gel electrolyte secondary cell with a negative electrode material including a graphitized carbonaceous material obtained from meso-carbon micro-beads can provide enhanced discharge capacity and charging/discharging efficiency. Thus, *Akashi* and the claimed invention seek to solve different problems in the art. Based on at least these reasons, one skilled in the art would recognize that *Akashi* is deficient with respect to the claimed invention.

Further, Appellants do not believe that the Patent Office can rely solely on *Ozaki* to remedy the deficiencies of *Akashi*. At the outset, Appellants question how the Patent Office can even justify combining the teachings of the cited art in the first place. Of course, the Court of Appeals for the Federal Circuit has held “there is no suggestion to combine . . . if a reference [*Ozaki*] teaches away from its combination with another source [(i.e., *Akashi*)].” *Tec Air, Inc. v. Denso Manufacturing Michigan Inc.*, 52 USPQ2d 1294 (Fed. Cir. 1999). Indeed, the *Ozaki* reference clearly disfavors the use of propylene carbonate as an organic solvent of the organic electrolyte for the non-aqueous electrolyte. See, *Ozaki*, col. 7, lines 5-8. In contrast, *Akashi* discloses that propylene carbonate is a preferred choice as a non-aqueous solvent. See, *Akashi*, page 4, lines 4-6. Based on this reason alone, *Akashi* and *Ozaki* should not be combined and thus the obviousness rejection should be withdrawn.

Even if combinable, Appellants believe that *Akashi* and *Ozaki* are deficient with respect to the claimed invention. Again, *Akashi* is clearly deficient with respect to at least the graphitized carbonaceous material features of the claimed invention as discussed above. While the *Ozaki* reference allegedly discloses mesophase graphite particles, why would one skilled in that art be inclined to modify *Akashi* to include same and allegedly arrive at the claimed invention.

As previously discussed, *Ozaki* clearly discloses that propylene carbonate is not employed as an organic solvent. Indeed, the claimed invention recites a gel electrolyte secondary cell that includes, in part, a negative electrode with a graphitized carbonaceous material obtained from meso-carbon micro-beads and a gel electrolyte that includes an

electrolyte salt, a high molecular weight material and a non-aqueous solvent that at least includes propylene carbonate in an amount ranging from 10 mol% to 75 mol% and ethylene carbonate.

At most, the combined teachings of *Ozaki* and *Akashi* arguably disclose a negative electrode as disclosed in *Ozaki* incorporated within a gel electrolyte secondary cell with a gel electrolyte that does include propylene carbonate as the non-aqueous solvent. Again, *Ozaki* effectively teaches away from the use of propylene carbonate as discussed above. Moreover, *Akashi* fails to disclose or suggest a negative electrode material made from mesophase graphite particles. Thus, one skilled in the art would recognize that the combined teachings of *Ozaki* and *Akashi* are clearly deficient with respect to the claimed invention.

Appellants respectfully submit that the Patent Office has merely relied on "hindsight reasoning" to support the obviousness rejection. Of course, this is clearly improper. Again, *Akashi* is at least deficient with respect to a negative electrode that includes a graphitized carbonaceous material obtained from meso-carbon micro-beads. Indeed, its primary focus relates to a fire-retardant gel electrolyte as discussed above. Further, *Ozaki* effectively teaches away from the use of propylene carbonate, let alone in combination with a negative electrode graphitized carbonaceous material as required by the claimed invention. Indeed, Appellants have demonstrated that a gel electrolyte secondary cell with a negative electrode material including a graphitized carbonaceous material obtained from meso-carbon micro-beads can provide enhanced discharge capacity and charging/discharging efficiency.

In view of same, Appellants believe that the cited art fails to disclose or suggest at least a number of features of the claimed invention. Therefore, even if combinable, Appellants respectfully submit that the cited art fails to render obvious the claimed invention.

Accordingly, Appellants respectfully request that the rejection of Claims 2-4, 6-9 and 12 under 35 U.S.C. § 103 be reversed.

IX. CONCLUSION

Appellants claimed invention set forth in Claims 2-4, 6-9 and 12 is neither taught nor suggested by the cited references, either alone or in combination. The Patent Office has failed to establish a *prima facie* case of obviousness with respect to the rejection of Claims 2-4, 6-9 and 12. Accordingly, Appellants respectfully submit that the rejection of pending Claims 2-4, 6-9 and 12 is erroneous in law and fact and should therefore be reversed by this Board.

Respectfully submitted,

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APPENDIX

2. The gel electrolyte secondary cell according to claim 12 wherein the gel electrolyte comprises a non-aqueous liquid electrolyte containing a non-aqueous solvent and an electrolyte salt and a high-molecular weight material having a nitrile group in its side chain.

3. The gel electrolyte secondary cell according to claim 12 wherein the high-molecular weight material having a nitrile group in its side chain is polyacrylonitrile.

4. The gel electrolyte secondary cell according to claim 12 wherein the high-molecular weight material having a nitrile group in its side chain is polyacrylonitrile and wherein the molar ratio of the acrylonitrile monomer to the non-aqueous solvent is 5:95 to 30:70.

6. The gel electrolyte secondary cell according to claim 12 wherein the non-aqueous solvent of the non-aqueous liquid electrolyte contains at least one selected from the group of γ -butyrolactone, methyl ethyl carbonate and dimethyl carbonate in addition to propylene carbonate and ethylene carbonate.

7. The gel electrolyte secondary cell according to claim 2 wherein the electrolyte salt of the non-aqueous solvent is LiPF_6 and wherein the concentration of this LiPF_6 with respect to non-aqueous solvent is 0.4 to 2 mol/cm³.

8. The gel electrolyte secondary cell according to claim 1 wherein the positive electrode contains a lithium-containing compound.

9. The gel electrolyte secondary cell according to claim 8 wherein the lithium-containing compound is a complex compound of lithium and a transition metal.

12. A gel electrolyte secondary cell comprising:
a positive electrode;

a negative electrode comprising a current collector and a powder mixture including a graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads and a binder, wherein the powder mixture is coated on the current collector at a thickness ranging from 10 μm to 200 μm ; and

a gel electrolyte comprising an electrolyte salt, a non-aqueous solvent and a high-molecular weight material having a number average molecular weight ranging from 5000 to 500000 wherein the non-aqueous solvent at least includes propylene carbonate in an amount ranging from 10 mol% to 75 mol% and ethylene carbonate.